Copy #1

INSTRUCTION MANUAL

P.O. 436848

Telonic

INDUSTRIES, INC

GFE 3804

W/S 5891-0002

WARRANTY

TELONIC INSTRUMENTS AND ACCESSORIES

Products manufactured by TELONIC INDUSTRIES, INC. are guaranteed against defective materials and workmanship for a period of one year (vacuum tubes excepted) from date of purchase. This warranty does not apply to instruments that have been altered, improperly handled or damaged in any way beyond our control.

Instruments must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

CHANGES IN SPECIFICATIONS

The right is reserved to change the published specifications of equipment at any time, and to furnish merchandise in accordance with current specifications, without incurring any liability to modify equipment previously sold.

RETURNING EQUIPMENT TO FACTORY

Factory service is available for repair and readjustment of this instrument. However, a description of the trouble, plus the MODEL AND SERIAL NUMBERS of the unit should be forwarded FIRST, whereupon instructions for correcting the trouble OR authorization for returning the equipment will be given. This applies to all units, whether under warranty or not.

MODEL S-5 S-5M

SERIAL NO. 6681

PLUG IN OSCILLATOR

CONTENTS

Page

SECTION I .. SPECIFICATIONS

SPECIFICATIONS 1

SECTION II .. OPERATING INSTRUCTIONS

TYPICAL SETUP 2
DESCRIPTION OF FRONT PANEL 2
GENERAL 2
DRAWING OF REAR PANEL 3
DESCRIPTION OF REAR PANEL 3

SECTION III .. GENERAL DESCRIPTION

GENERAL 4
SWEEP OSCILLATOR 4
VARIABLE MARKER 5

SECTION IV .. CALIBRATION PROCEDURE

TYPICAL SETUP 6
GENERAL 7
TEST EQUIPMENT 7
PROCEDURE 7
SWEEP WIDTH ADJUSTMENT 7
BLANKING PHASE ADJUSTMENT 8
HORIZONTAL PHASE ADJUSTMENT 8
LINEARITY CHECK 8
SWEEP B+ ADJUSTMENT 9
MAX AND MIN LEVEL LIMIT 9
FLATNESS CHECK 10
VARIABLE MARKER CHECK 11

SECTION V .. MAINTENANCE

GENERAL PROCEDURE 13
EXTENSION CABLE 13
ACCESS TO RF COMPARTMENT 13
TROUBLE-SHOOTING CHART 14
PHOTOGRAPH AND PARTS LOCATION 16

SECTION VI .. PARTS LIST

PARTS LIST FOR OSCILLATOR SECTION 17
VARIABLE MARKER PARTS LIST 18
ABBREVIATION CODE 18

SECTION VII .. SCHEMATIC DIAGRAMS

SECTION I .. SPECIFICATIONS

INTRODUCTION

The S-5 is a plug-in sweep oscillator for use with designated Telonic Control Chassis. The sweep ratio and sweep rate functions of the control chassis are not utilized with this unit.

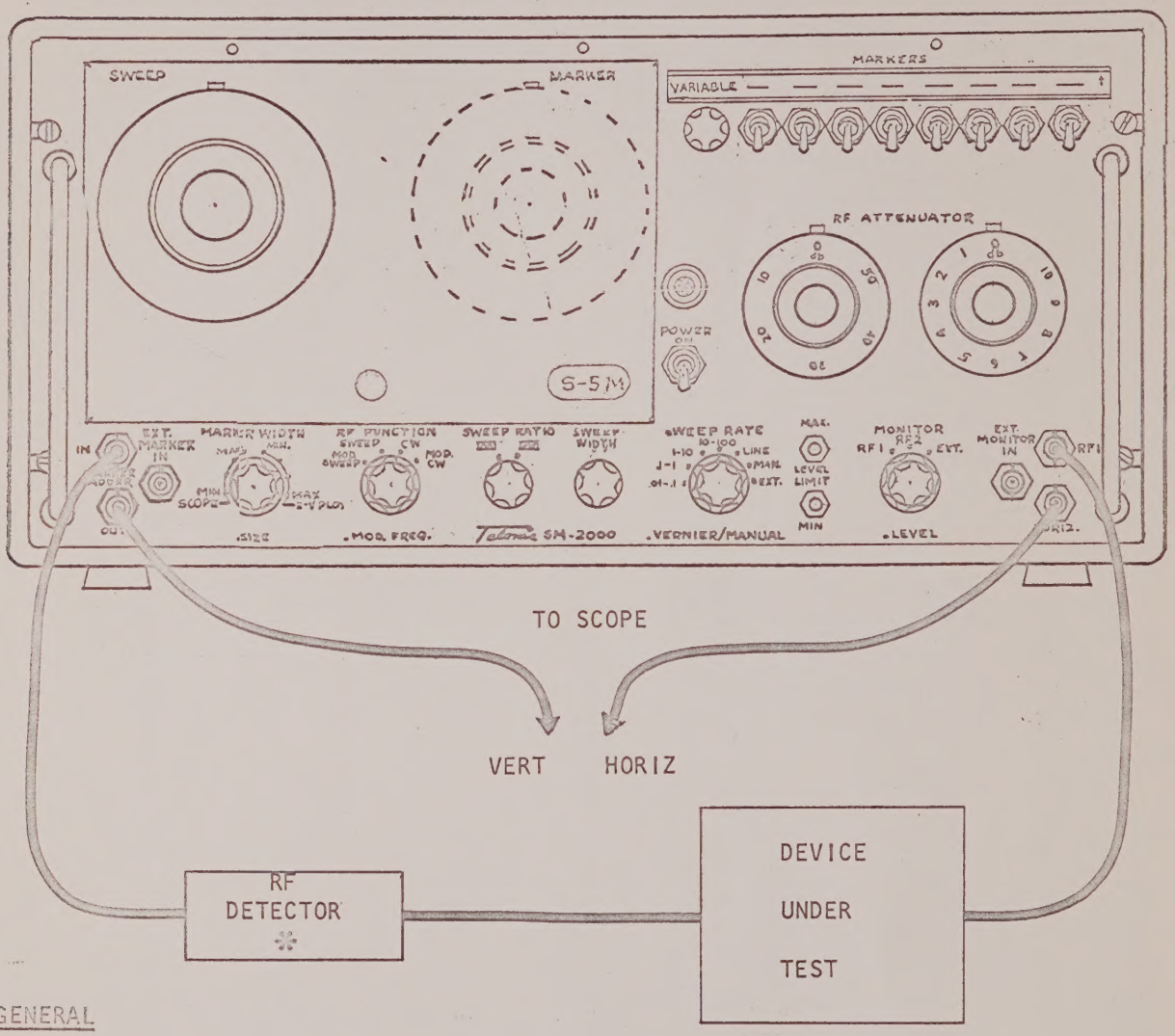
The S-5M includes a variable marker covering the entire sweep range. This difference is clearly indicated throughout the manual.

SPECIFICATIONS

CW AND SWEEP CENTER FREQUENCY RANGE	460-920 Mc
SWEPT FREQUENCY RANGE	435-970 Mc
SWEEP WIDTH	0.02-10%
OUTPUT VOLTAGE	
Sweep	1 vrms
Approximate CW Output	0.5 vrms
FLATNESS	
At Maximum Sweep Width	$\pm$0.5 db
Overall	$\pm$1.0 db
LINEARITY	1.2:1 or better
VARIABLE MARKER (S-5M only)	
Frequency Range	435-970 Mc
Accuracy	$\pm$0.25%
VERNIER RF LEVEL CONTROL RANGE	0-6 db

SECTION II .. OPERATING INSTRUCTIONS

TYPICAL SET UP



GENERAL

DESCRIPTION OF FRONT PANEL

SWEEP — The sweep dial, which sets the center frequency of the sweep oscillator by means of a variable capacitor.

MARKER — The variable marker dial, calibrated to cover the full swept range of the unit. This control adjusts frequency by varying the length of a tuned line.

GENERAL

1. Make sure the control chassis power is OFF before inserting the plug-in oscillator into the Control Chassis. If the power is ON, transient voltages may damage diodes in the units. Insert plug-in oscillator and secure it in the chassis by tightening the fastening rod with the knob in the lower center of the front panel.

2. Make connections to the scope (or recorder), the device under test, and RF Detector as shown. All connectors located on the control chassis are "BNC" type. It is recommended that RG Cable be used for all connections to insure good ground connections and to minimize hum, leakage, and spurious signal pickup. The cable used to connect the RF output to the device under test should have a characteristic impedance of 50Ω. If the input impedance of the device under test is other than 50Ω, a matching network should be used to insure a constant input signal.

3. Connect the device under test to the RF 1 output on the control chassis.

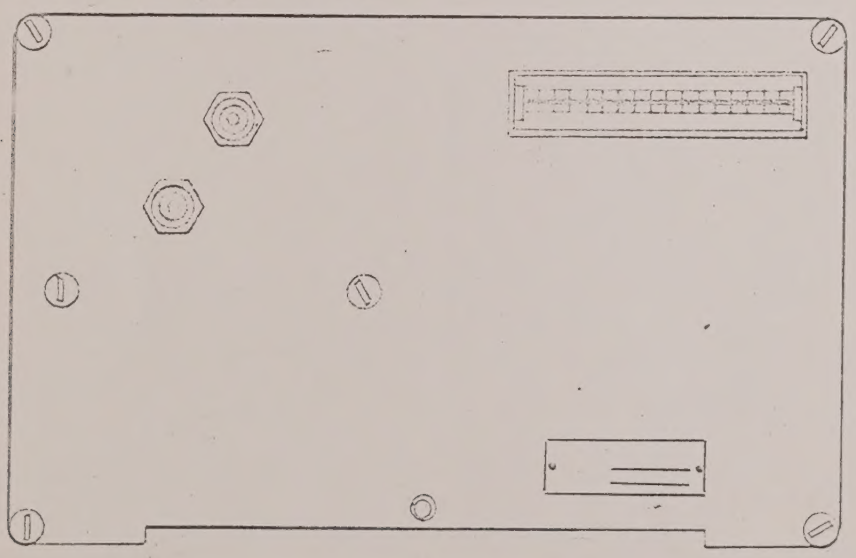
4. Refer to the manual for the Control Chassis for additional instructions. NOTE: To insure a constant amplitude output signal, the LEVEL MAX and MIN Controls should be set as prescribed in the control chassis manual and in the CALIBRATION PROCEDURE of this manual. These adjustments vary with the individual oscillator.

5. To insure proper operation of both units, refer to Section IV (CALIBRATION PROCEDURE) of both manuals.

6. Proceed in accordance with recommendations of the manufacturer of the device under test concerning alignment, adjustment, and tests.

*See Telonic literature for suitable detector for this use.

DRAWING OF REAR PANEL



DESCRIPTION OF REAR PANEL

The three electrical connectors on the rear panel are:

Two BNC plugs, which mate with BNC jacks on the Control Chassis. These are the RF output connector (RF 1 frequency) and variable marker (RF) output.

A 32-contact plug which makes the other electrical contacts necessary through a mating jack on the control chassis.

SECTION III .. GENERAL DESCRIPTION

GENERAL

The S-5 plug-in oscillator has an RF output at the fundamental frequency of a tuned-line oscillator. Center frequency tuning is accomplished by variable capacitors across the line.

The variable marker is produced by a CW oscillator which is tunable on the front panel. Variable tuned-line circuitry is used between plate and grid.

SWEEP OSCILLATOR

The sweep oscillator employs a 6AF4A in a tuned line type oscillator circuit. Center frequency tuning is accomplished by precision machined capacitors.

A linear sweep (frequency change versus horizontal display) is provided by variable inductances which are sine wave driven mechanically by a motor secured at the base of the sweep oscillator assembly. Inductance change occurs when a silver strap mounted on a fiber glass cylinder vibrates and cuts the flux path of the tuned lines. The rate of vibration is fixed at 60 cycles (line frequency) and the amplitude is controllable by the control chassis and S-5 SWEEP WIDTH Controls. The position of this strap on the fiber glass cylinder and in relation to the tuned lines is carefully adjusted at the factory for optimum linearity and sweep width. Since a sine wave voltage is used to drive the motor and horizontal deflection plates of the oscilloscope, the frequency change versus horizontal deflection trace appearing on the scope represents the true linearity of the sweep oscillator.

The signal is coupled to the RF 1 output connector on the Control Chassis front panel through a low-pass filter in the S-5 and through a monitor block and the RF attenuators in the control chassis.

See the Control Chassis Manual for discussion of monitoring and leveling action.

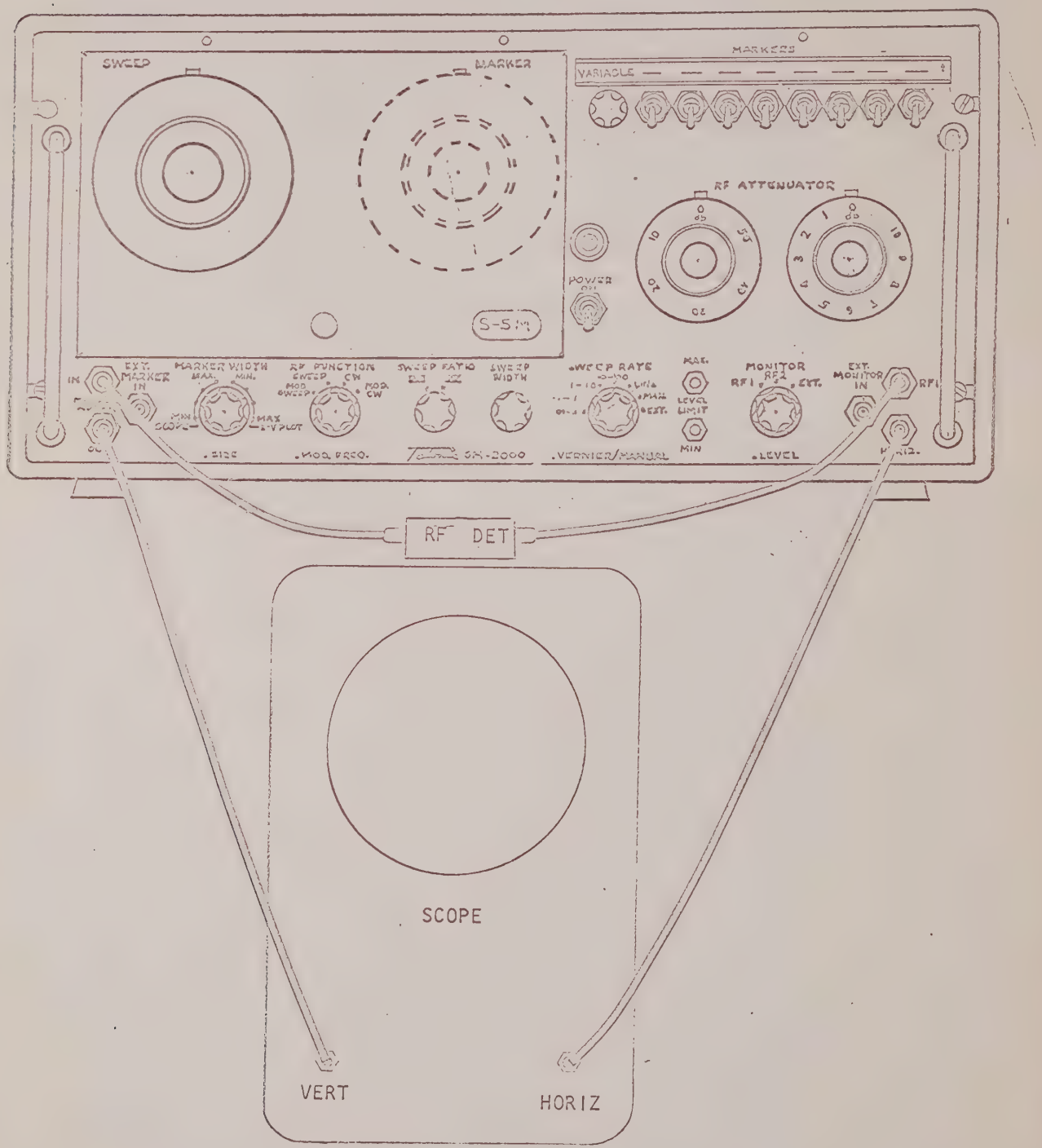
VARIABLE MARKER (S-5M ONLY)

The variable marker oscillator uses a 6AF4 tube, and is tuned by adjusting its tuned lines. The tuning range of the marker is sufficient to cover the entire range of the sweep oscillator. A 5:1 vernier drives the marker dial which is individually calibrated to an accuracy of 1/4 of 1%.

The output from the variable marker oscillator is then fed into a crystal diode mixer where it is mixed with a sample of the sweep oscillator signal. The resultant birdy is then fed into the birdy-by-pass amplifier.

SECTION IV .. CALIBRATION PROCEDURE

TYPICAL SET UP



NOTE: For greater accuracy, certain adjustments (specified in the text) should be performed with a power meter replacing the detector and scope in the above setup.

GENERAL

The following procedure should be applied after changing any component in the S-5 plug-in oscillator or at any time the calibration is noted to be incorrect.

Complete calibration of the S-5 involves adjustment of two classes of controls.

Those located in the S-5 which affect the operation of the control chassis.

Those located in the control chassis which affect the operation of the S-5.

NOTE: Although preliminary adjustments may be made with the cover removed from the oscillator section, final adjustment requires that the cover be in place.

TEST EQUIPMENT

50Mc harmonic marker (such as the Telonic Model CDH-50)
5Mc harmonic marker (such as the Telonic Model CDH-5.0)
50Ω RF power meter
RF detectors (see Telonic literature for recommended detectors)
Oscilloscope

PROCEDURE

1. Make connections as shown.

2. Use double-shielded (RG) 50Ω cable for all RF connections to insure good connections and minimum radiation, and to avoid pickup of spurious signals. The detector must match the 50Ω cable, or a matching network must be used.

3. With power OFF, plug in the S-5 and secure in place.

4. Turn power ON, allow a 15 minute warmup period, and make adjustments as outlined.

SWEEP WIDTH (Adjustment)

This adjustment is set to provide 10% sweep width. Since the percent of sweep width increases only very slightly with frequency, a 10% setting at 500 Mc assures sufficient sweep width at all frequencies.

Preset the following controls:

Control Chassis
SWEEP WIDTH fully clockwise
RF FUNCTION Switch to SWEEP
MONITOR Switch to RF 1
5 Mc harmonic marker ON
All other markers OFF

S-5
Sweep dial to 500 Mc

CALIBRATION PROCEDURE

Adjust S-5 SWEEP WIDTH Control for ten full marker intervals on the scope. This can be accomplished accurately by alternately adjusting the SWEEP dial and SWEEP WIDTH Control to place a marker at each end of the trace with nine markers between. Due to some non-linearity in the sweep, the SWEEP dial will not read exactly 500 Mc at the conclusion of this adjustment.

BLANKING PHASE (Adjustment)

After the sweep width adjustment, this control is set for a rectangular pattern. Misadjustment will result in a pattern similar to the following:

HORIZONTAL PHASE (Adjustment)

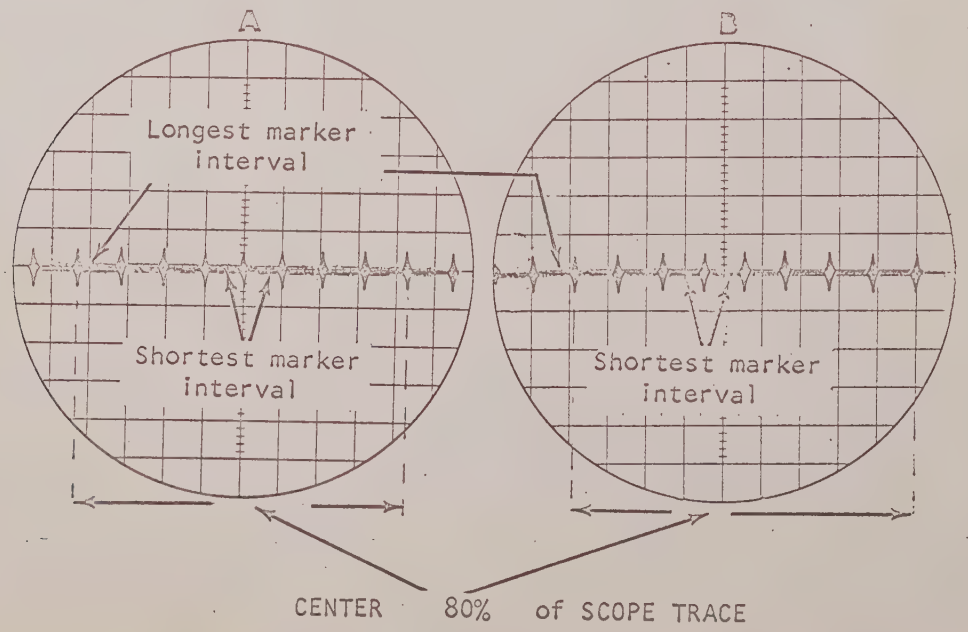
After completing the blanking phase adjustment, set this control for the best linearity possible, still maintaining a reasonably rectangular pattern. See LINEARITY CHECK below. If necessary, readjust the BLANKING PHASE Control following this adjustment.

LINEARITY CHECK

Linearity measurements are made over the center 80% of the display at 10% sweep width.

Leave controls set as at the conclusion of the HORIZONTAL PHASE adjustment.

Locate the shortest marker interval in the center 80% of the display. Adjust the horizontal gain control on the scope so that this interval occupies exactly one scope division. See Figure A below. Locate the longest marker interval in the center 80% of the display. Adjust the horizontal position on the scope so that the interval begins on a graticule line. See Figure B below. Measure the marker interval. Its length (in scope divisions) indicates the linearity ratio: A length of 1.15 scope divisions for the longest marker interval represents a linearity of 1.15 to 1.



SWEEP B+ (Adjustment)

This control limits the maximum oscillator B+ to a safe operating level. It is set for rated RF output.

1. Connect the RF 1 output to a 50Ω RF power meter.

2. Preset the following controls:

   Control Chassis
   - RF FUNCTION Switch to SWEEP
   - SWEEP WIDTH fully counter-clockwise
   - MONITOR Switch in EXT position
   - LEVEL fully clockwise
   - MAX LEVEL LIMIT for maximum output
   - RF ATTENUATORS to 0 db position

   S-5
   - SWEEP B+ fully counter-clockwise
   - SWEEP Dial for frequency at which output is lowest

3. Adjust the SWEEP B+ for just over 10 mw output (1/2 of the 20 mw rated output, allowing the 50% duty cycle of the sweep oscillator).

   NOTE: A fixed B+ limit is used in the CW, MOD CW Modes.

MAX and MIN LEVEL LIMIT (Control Chassis).

The procedure outlined in the Control Chassis Manual for setting these controls is repeated here, with additional information peculiar to operation with the S-5.

1. With the power meter still connected and controls set as at the conclusion of the SWEEP B+ Adjustment, adjust the MAX LEVEL LIMIT for rated output.

2. Disconnect the power meter and reconnect scope and detector as shown in TYPICAL SETUP.

3. Insert fixed attenuation in an amount equal to the desired range of the LEVEL Control.

4. Note the level of the scope pattern.

5. Remove attenuation, rotate LEVEL Control fully counter-clockwise. Set MIN LEVEL LIMIT for same scope deflection as seen in Step 4.

FLATNESS CHECK

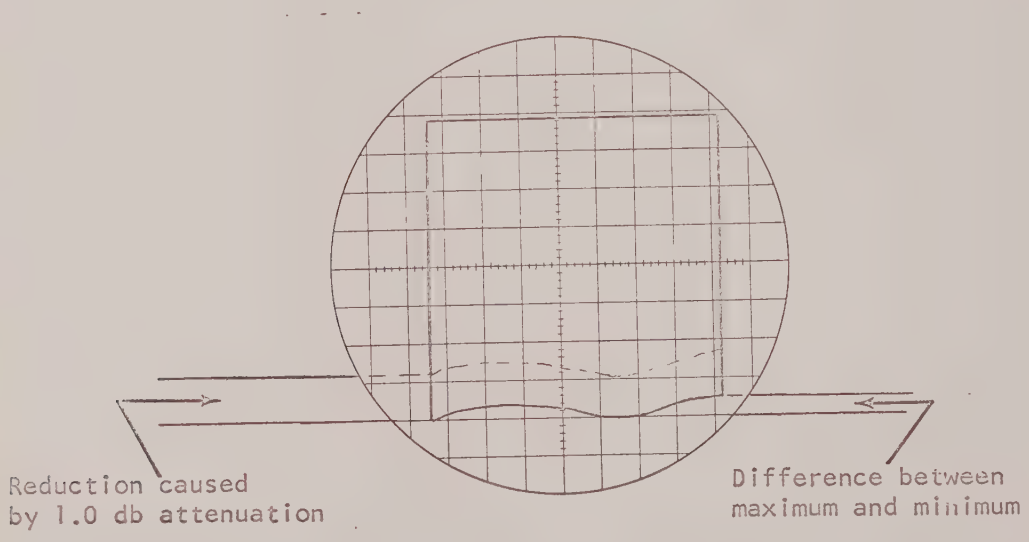
Flatness is measured over maximum sweep width. At any center frequency setting, the minimum output at full sweep width must be no more than 1.0 db lower than the maximum for the RF 1 output.

1. With controls set as above, rotate the LEVEL and SWEEP WIDTH Controls fully clockwise, and set MONITOR SELECTOR to RF 1.

2. Rotate the SWEEP Dial to locate the point at which maximum tilt, or other unflatness feature, occurs.

3. Note the difference between maximum and minimum output levels.

4. Insert 1 db of attenuation and compare the reduction in output with the noted difference between maximum and minimum. The difference between maximum and minimum output must be no more than the signal reduction caused by 1 db of attenuation.



VARIABLE MARKER CHECK

Although there are no adjustable electrical components in the variable marker circuit to compensate for dial inaccuracies, the following procedure can be used to restore specified dial accuracy when tube replacement is necessary:

> NOTE: All marker dial calibrations are made with the tube well-seated in the socket. If the tube is positioned otherwise, the high frequency end of the range will be shifted.

1. Obtain several 6AF4A tubes which have been aged several days with filaments continually burning.

2. Turn on both harmonic markers and the variable marker. Check the marker dial accuracy at 435 Mc by superimposing the variable marker over the 435Mc harmonic marker. If calibration at this point is incorrect, loosen the set screw holding the knob and dial assembly to the tuning shaft and rotate the dial to bring the 435 Mc dial mark under the indicator hairline.

3. Similarly check the marker dial accuracy at 970 Mc. If dial is inaccurate, select a tube from the aged stock which will restore accuracy at this point. Usually the effect of tube selection on the high frequency end is considerable, but negligible on the low frequency end.

4. Recheck each end of the range as above until best possible overall accuracy is obtained.

Factory recalibration service is also available.

SECTION V .. MAINTENANCE

GENERAL PROCEDURE

Since the Model S-5 is a plug-in unit, many of the possible malfunctions of the oscillator are the result of part failure in the control chassis. The connections at P601 of the S-5 and at J601 of the control chassis afford a convenient means of tracing the source of troubles to the oscillator or chassis.

In locating troubles which have been traced to the oscillator, application of the common rules of electronic maintenance, including a visual check for damage, open filaments, glowing anodes, shorted tuning capacitors, and charred resistors, is an obvious measure. All connectors, particularly P601 and J601, should be checked for cleanliness.

EXTENSION CABLE

For maintenance work requiring access to parts located on the under side of the S-5 or in other areas not easily reached, an extension cable may be obtained from Telonic Industries, Inc. This cable, having the 32-contact plug on one end and the 32-contact jack on the other, allows the S-5 to be removed from the control chassis and operated on the bench.

ACCESS TO RF COMPARTMENT

To take off the top cover of the oscillator compartment, remove the necessary screws. See photograph, Page 16

> CAUTION: The red-lacquered screws securing the drive motor to the bottom of the compartment should not be disturbed. The position of this drive motor is critical, and these mounting screws are factory adjusted for optimum oscillator performance.

The following chart will be of service in deciding whether a trouble lies in the oscillator or control chassis.

SYMPTOM	CHECK (Pin Numbers Refer to P601)
Weak or no output or unleveled output	DC voltage at Pin 31 with RF LEVEL fully clockwise.
No sweep width	Resistance between Pins 27 and 9, 26 and 27, 26 and ground
No variable marker (plug-in marker present)	1. For birdy at Pin 17
	2. DC voltage at Pin 1

If the chart shows that the trouble probably is in the control chassis, refer to the MAINTENANCE Section of the manual for that unit. A common trouble is unleveled RF l output due to failure of the monitor diode in the control chassis. This part can be replaced as necessary by following the procedure outlined in the control chassis manual.

If the trouble appears to be in the S-5M the following chart may be of assistance in localizing the failure.

SYMPTOM	CHECK
Output absent, weak, or unleveled	V701 and associated components
No sweep width	Resistance, P601-26 to ground R605
No variable marker	Feed an external CW source in the variable marker range to the control chassis EXT MARKER input and check for birdy. If none appears as the variable marker is tuned across the frequency of the external signal, the marker oscillator probably is inoperative. Check V801, then other components if necessary.

It is assumed that the above procedures have been applied and that the jumpers on P601 are intact. Where "inconclusive" is shown, the next step should be followed.

IF RESULT IS	TROUBLE PROBABLY IN OSCILLATOR	CONTROL CHASSIS
High 100-175v	X	
Low or zero 0-100v		X
Open between		
27 and 9	X	
26 and 27		X
26 and ground	X	
Continuity on all checks		X
Birdy present		X
No birdy	Inconclusive.	See Check #2. ↓
100v	X	
Low or no voltage		X

SCHEMATIC PART DESIGNATION

C	Capacitor
CR	Crystal Rectifier
J	Jack
L	Inductor
P	Plug
R	Resistor, Fixed or Variable
V	Tube
Z	Miscellaneous

SCHEMATIC VALUE ABBREVIATION

Ω	ohms
K	1,000 ohms
M	1,000,000 ohms (megohms)
µf	Microfarad
pf	Picofarad
µh	Microhenry
mh	Millihenry

OTHER ABBREVIATIONS

F.P.	Front Panel
R.P.	Rear Panel
T.P.	Test Point

RESISTORS - All resistors are 1/2 watt, ± 10%, and are shown in ohms, unless otherwise specified.

CAPACITORS - All capacitors are shown in picofarads (pf) unless otherwise specified.

COILS - All inductors are shown in microhenries (µh) unless otherwise specified.

CIRCUIT REFERENCE SYMBOL - LOCATION INFORMATION

601 - 699	Interconnecting elements	701 - 799	Sweep Oscillator
		801 - 899	Variable Marker

*Indicates value of component adjusted at factory, and may deviate from value shown on print.

SECTION VI .. PARTS LIST

CIRCUIT REFERENCE	DESCRIPTION	TELONIC PART NUMBER
C601	CFP, 0.1 f, ±20%, 200 vdcw	C-200
C701	CVA (Part of L701)	NA
C702	CVA (Part of L702)	NA
C703	CFCF, 1000 pf, ±20%, 500 vdcw	C-89
C704	Same as C703	
C705	Same as C703	
J701	Part of Z701	NA
P701	PC, UG-88B/U	J-32
P702	PC, 4961-1	J-27
L701	IF, Tuned Line	NA
L702	IF, Tuned Line	NA
L703	IF, Coupling Strap	NA
L704	IF, 2.2 µh	L-100
L705	IF, 2.2 µh	L-101
L706	IF (SC)	NA
L707	Same as L705	
L708	Same as L704	
R601	RVC, 50KΩ, 2W	R-751
R602	Same as R601	
R603	RFC, 56KΩ, ±10%, 1/2W (SC)	R-71
R604	RFC, 22KΩ, ±10%, 1/2W (SC)	R-24
R605	RVW, 25Ω, 2W	R-713
R606	Same as R601	
R607	RFC, 10KΩ, ±10%, 1/2W	R-23
V701	TE, 6AF4A	VT-4
Z701	Filter, low pass	34008
Z702	Drive Motor	34009
	Shield, Tube heat dissipating	S-16

VARIABLE MARKER (S-5M ONLY)

CIRCUIT REFERENCE	DESCRIPTION	TELONIC PART NUMBER
C801	CFC, 10 pf, ±10%, 1000 vdcw	C-6
C802	CFN, 0.18 pf, ±10%, 500 vdcw	C-31
C803	CFCF, 1000 pf, ±20%, 500 vdcw	C-39
C804	Same as C803	
C805	Same as C803	
C806	Same as C803	
J801	TC, MX-1684/U	J-9
P801	PC, UG-536/U	J-52
L801	IV, Tuned Line	NA
L802	IF	NA
L803	IF, 2.2 µh	L-101
L804	Same as L803	
L805	IF, 2.2 µh	L-100
L806	IF (SC)	NA
R801	RFC, 2.2KΩ, ±10%, 1/2 W	R-20
R802	Same as R801	
R803	RFC, 56Ω, ±10%, 1/2 W	R-13
R804	Same as R803	
R805	RFC, 1KΩ, ±10%, 2 W	R-302
V801	TE, 6AF4A	VT-4

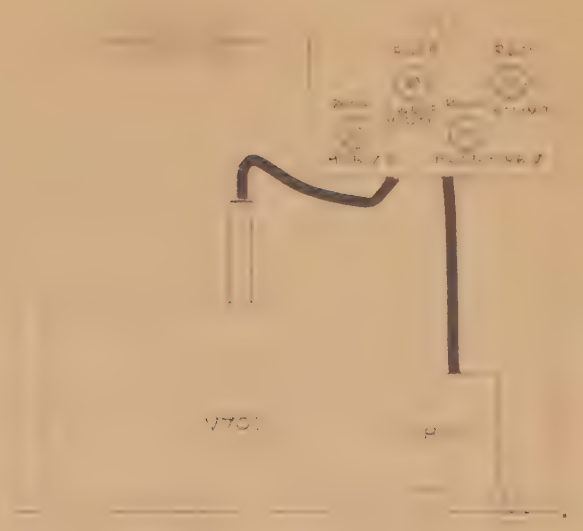
ABBREVIATION CODE

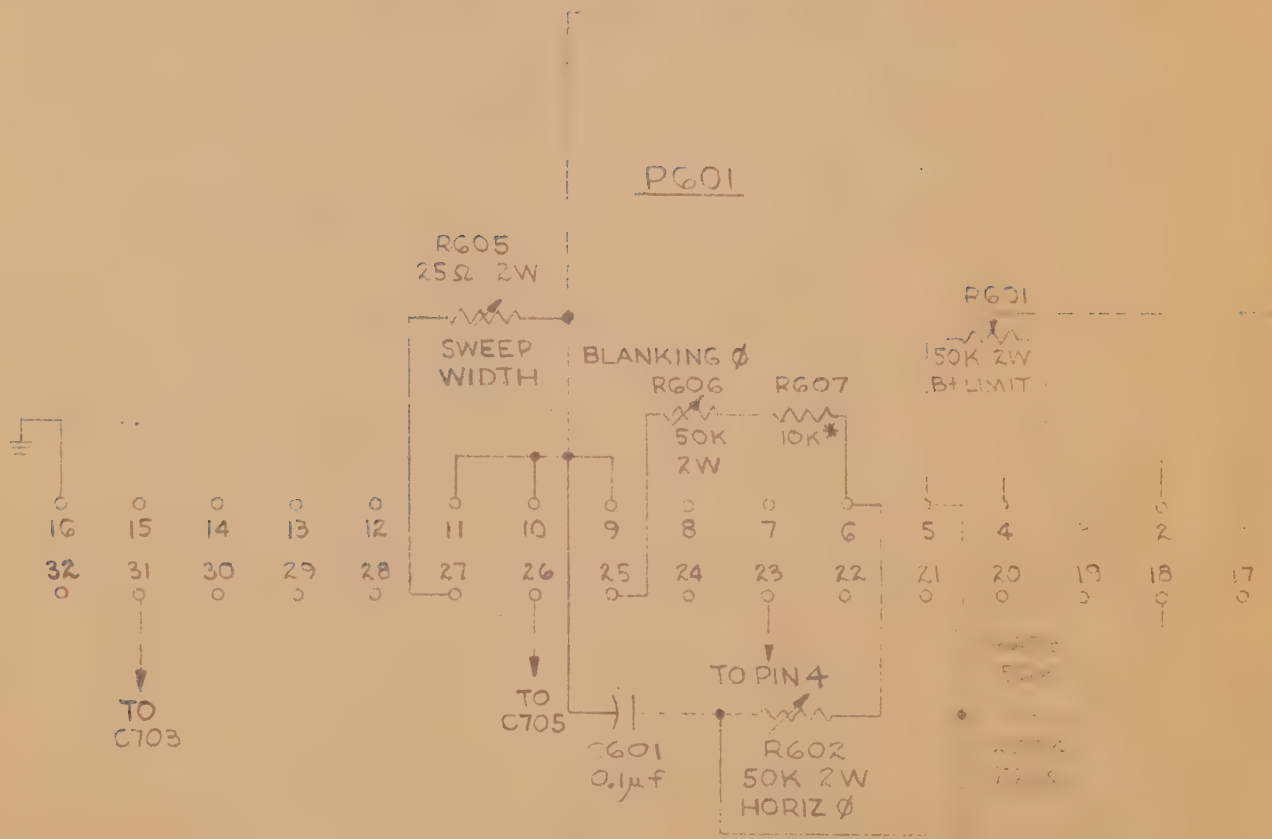
CFC	Capacitor, fixed, ceramic
CFCF	Capacitor, fixed, ceramic feed-thru
CFN	Capacitor, fixed, composition
CFP	Capacitor, fixed, paper
CFT	Capacitor, fixed, Teflon
CVA	Capacitor, variable, air
DSD	Device, semiconductor diode
IF	Inductor, fixed
IV	Inductor, variable
JC	Jack, cable
NA	Not assigned
PC	Plug, cable
RFC	Resistor, fixed, composition
RJ	Receptacle, Jack
RVC	Resistor, variable, composition
RVW	Resistor, variable, wirewound
SC	This part subject to change
TC	Terminator, cable
TE	Tube, electron

SECTION VII

SCHEMATIC DIAGRAMS

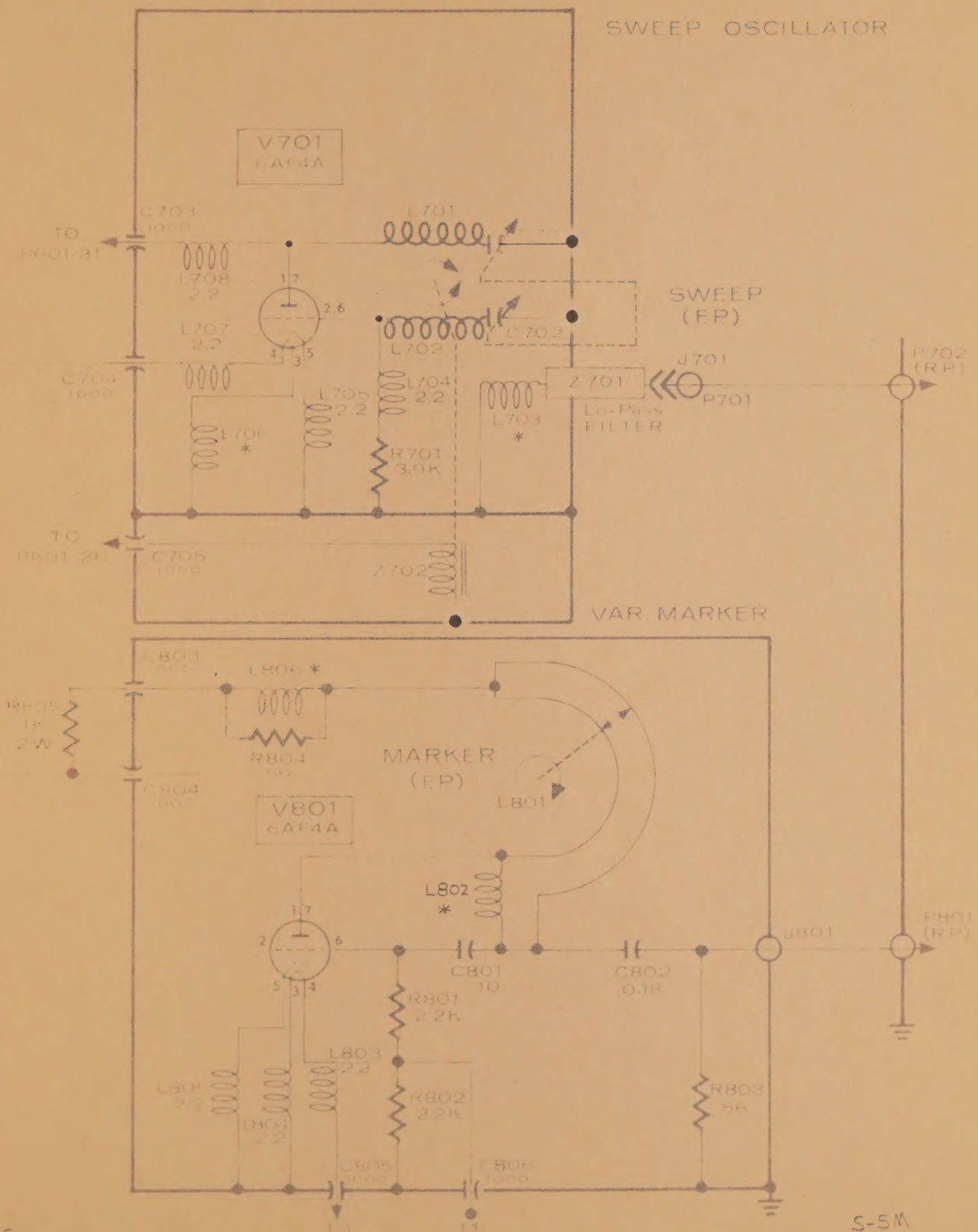
CHASSIS LAYOUT
(TOP VIEW)





2571S
11/62

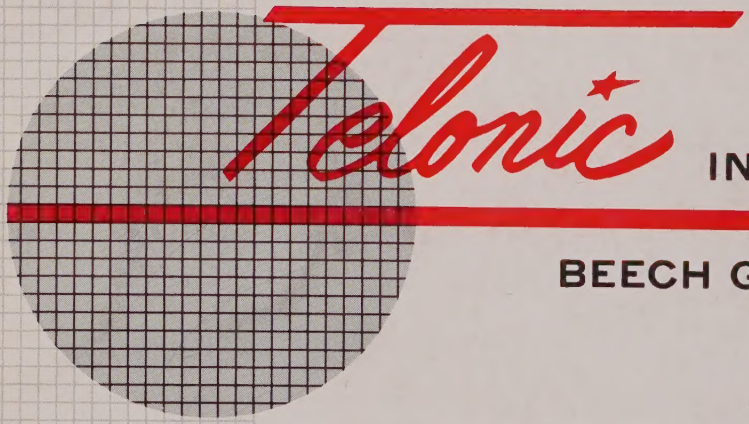
SA005-0105 55M



25725
11/62

S-5M

SA005-0111



INDUSTRIES INC.

BEECH GROVE, INDIANA

92982